

REMARKS/ARGUMENTS

This application contains claims 1, 2, 9 through 13 and 16. Claims 1 and 11 (the independent claims) have each been amended to require that the DLC surface be the surface of certain specified engine parts; specifically cam shaft parts, pistons, cylinder liners and engine valves, which engine parts are known to require proper lubrication and are conventionally formed of metal, such as iron or aluminum. These claims were previously amended to require that the “organo-molybdenum compound” of the lubricating oil composition be a trimeric molybdenum dithiocarbamate compound.

Claims 1, 2, 9 through 13 and 16 all the claims of the application, stand rejected under 35 USC Section 103(a) as being unpatentable over U.S. Patent No. 6,063,741 to Naitoh et al. (hereinafter the “Naitoh et al. ‘741 patent”), in combination with either U.S. Patent No. 6,139,022 to Iwashita et al. (hereinafter the “Iwashita et al. ‘922 patent”) or U.S. Patent No. 6,325,385 to Iwashita et al. (hereinafter the “Iwashita et al. ‘385 patent”). The Naitoh et al. ‘741 patent was cited as teaching lubricating oil compositions containing, *inter alia*, molybdenum compounds. Each of the Iwashita et al. ‘922 patent, the Iwashita et al. ‘385 patent was cited for teaching engine piston rings coated with a diamond-like carbon film. It is alleged that, as the Naitoh et al. ‘741 patent teaches that certain lubricants containing molybdenum compounds provide advantages in “engines”, it would obvious to use such compositions to lubricate parts having diamond-like carbon (DLC) coatings because the term “engines” does not exclude engines having DLC coated parts. Applicants respectfully traverse these grounds for rejection.

The present invention is directed to an internal combustion engine having one or more metal engine parts or components selected from the group consisting of a cam shaft, piston, cylinder liner and valve that are coated with a diamond-like carbon film, lubricated with a lubricating oil composition containing an effective friction-reducing amount of an oil-soluble trinuclear molybdenum dithiocarbamate compound. The only DLC coated engine part described in the Iwashita et al. ‘922 patent and the Iwashita et al. ‘385 patent is a piston ring. Piston rings, in operation, are subjected to particularly high temperatures and cannot, in operation be adequately lubricated when at “top dead center”, or where the piston is at the top of the stroke, in contact with the combustion chamber, and changing direction from up stroke to down stroke, or moving relatively slowly following such change in direction. For these reasons, piston rings are advantageously made to be much harder than the cylinder liner to avoid excessive wear and, to

the extent possible, self lubricating or to resist wear without lubrication. These patents teach no other engine part having a DLC coated surface. The present claims, in contrast, require a metal cam shaft part, piston, cylinder liner or engine valves having a DLC coating. The Naitoh et al. '741 patent makes no mention of engine parts having a DLC coating. The Naitoh et al. patent also fails to disclose anything regarding trimeric molybdenum dithiocarbamate compounds or lubricating oils containing same. More specifically, the molybdenum dithiocarbamate compounds used in the lubricating oil compositions of the Naitoh et al. patent are expressly dimeric molybdenum dithiocarbamates (see formula (1) in col. 3 and the preceding statement “[t]he molybdenum dithiocarbamate (MoDTC) to be used as an additive in the present invention is a compound expressed by the following formula (1)”).

Further, prior art previously presented for consideration establishes that dimeric molybdenum dithiocarbamate compounds were considered ineffective as friction modifiers when used in lubricants for the lubrication of DLC coated materials. Specifically, as described, for example, in US Patent No. 6,806,242 Shirahama et al., it was known that while DLC coated materials themselves provide lower frictional coefficients than uncoated surfaces in air, they do not display the same advantage in the presence of a lubricant (see Japan Tribology Congress 1999.5, Tokyo, Proceeding Page 11-12, Kano et al.), and the frictional coefficient of DLC coated surfaces cannot be sufficiently lowered in the presence of lubricating oil by using organomolybdenum compounds *per se* (see World Tribology Congress 2001.9, Vienna, Proceeding Page 342, Kano et al.). US Patent No. 6,806,242 further supports the conventional belief that organo-molybdenum compounds are not effective friction modifiers when used in compositions for the lubrication of DLC coated surfaces and teaches that fatty acid or aliphatic amine friction modifiers are the only suitable friction modifying components under such circumstances. This body of research actually leads away from the present invention as one skilled in the art, knowing that organo-molybdenum compounds, in general, were not effective, would not expect that one specific class of such compounds, trimeric molybdenum dithiocarbamate compounds, are extremely effective friction modifiers for use with DLC coated surfaces. In fact, based on this body of research, one skilled in the art would be dissuaded from even testing such compounds.

Therefore, applicants submit that combination of the Naitoh et al. '741 patent and either the Iwashita et al. '922 patent or the "Iwashita et al. '385 patent, fails to render obvious the invention as now claimed.

Claims 1, 2, 9 through 13 and 16 stand further rejected under 35 USC Section 103(a) as being unpatentable over U.S. Patent No. 6,444,624 to Walker et al. (hereinafter the "Walker et al. patent") in view of U.S. Patent No. 6,893,720 to Nakahigashi et al. (hereinafter the "Nakahigashi et al. patent"). The Walker et al. patent was cited as teaching lubricating oil compositions containing, *inter alia*, molybdenum compounds. The Nakahigashi et al. patent was cited for teaching objects, such as engine parts, coated with a diamond-like carbon film. It is alleged that, as the Walker et al. patent teaches that certain lubricants containing molybdenum compounds provide advantages in "engines", it would obvious to use such compositions to lubricate parts having diamond-like carbon (DLC) coatings because the term "engines" does not exclude engines having DLC coated parts. Applicants respectfully traverse these grounds for rejection.

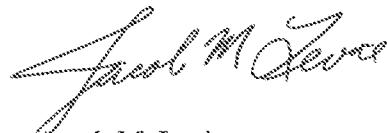
The Nakahigashi et al. patent is directed to certain apparatus parts, which can be parts for bicycles, sports articles, toys, umbrellas or automobiles, which parts are made of polymer materials (resin or rubber) or glass, surface coated with a carbon film, such as a DLC coating to improve wear resistance, lubricity, water repellency and gas barrier properties. The "automobile parts" noted in the Nakahigashi et al. patent include rubber or resin vibration dampers, hoses, tires, seals and windows, as well as automobile valve parts made of resin. The present claims, as noted *supra*, are, in contrast, directed to metal cam shaft parts, pistons, cylinder liners and engine valves, none of which are disclosed or suggested by the Nakahigashi et al. patent. The Walker et al. patent is directed to lubricating oil compositions containing a calcium detergent and a certain amount of molybdenum, which may be provided by any oil-soluble molybdenum compound. While the Walker et al. patent mentions trimeric molybdenum dithiocarbamate compounds, the patent does not distinguish such compounds from dimeric molybdenum dithiocarbamate compounds, or other noted types of molybdenum compounds. As the Nakashita et al. patent fails to disclose the specific DLC coated metal parts identified in the present claims, or other DLC coated parts that would be conventionally lubricated with a lubricating oil composition, and the Walker et al. patent fails to suggest that in the lubrication of any engine part a trimeric molybdenum compound will provide any advantage over any other type of molybdenum

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compound, applicants submit that the combination of the Nakashita et al. patent and the Walker et al. patent fails to establish even a *prima facie* case of obviousness under 35 USC Section 103.

Based upon the foregoing, applicants submit that the invention as claimed is distinguishable over the cited combination of prior art references. Applicants therefore respectfully request that all grounds for rejection presented under 35 USC Section 103(a) be withdrawn and the application now be passed to issue.

Respectfully submitted,



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